VOLATILITY OF THE AUSTRALIAN DOLLAR EXCHANGE RATE

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ABSTRACT

Since the floating of the Australian dollar in December 1983, questions have been raised from time to time about whether the currency is "excessively" volatile. This paper assesses the volatility of the dollar in the four years prior to the float and in the six years thereafter. The results show that while the variability of the Australian dollar has indeed increased since the float, it remains less volatile on a bilateral basis than most other major currencies and less volatile than the prices of several other assets. Furthermore, the increase in volatility of the local currency is not unique but reflects a more turbulent global foreign exchange market.

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1. Introduction

Participants and observers of the foreign exchange market question from time to time whether the Australian dollar has been particularly volatile since it was floated in December 1983. Some have suggested that the Reserve Bank might play a greater role in smoothing the dollar's path during periods of excessive fluctuation.

While the Australian dollar has at times fluctuated widely, it is not obvious that movements have been "excessive". This paper examines the volatility of the Australian dollar in both the period immediately prior to the floating of the exchange rate and in the six years thereafter. In particular, it uses two measures to compare the volatility of the Australian dollar with the volatility of other currencies and some domestic asset prices. Section 2 discusses methodology, Section 3 details the results and Sections 4 and 5 evaluate the outcome.

2. Measuring Volatility

There are two commonly used measures of exchange rate volatility: the average of absolute exchange rate movements and the standard deviation of percentage changes.[1] As its name suggests, the former is simply an arithmetic average of the absolute value of percentage movements in an exchange rate, while the latter measures the dispersion of exchange rate movements.

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[1] See, for example, Frenkel and Mussa (1980), Frenkel and Goldstein (1989), and MacDonald (1988).

Despite their obvious computational differences, the average absolute change and the standard deviation measures are similar in that every movement in the exchange rate over a period of time is assumed to contribute to volatility. A different approach is one that reflects deviations from an expected or trend forecast of future exchange rates. This approach recognises that much of the concern with volatility lies with an increased likelihood of error in exchange rate forecasts and its consequences for the efficiency of foreign exchange markets. Hence, it has been asserted that if some part of a currency's fluctuation is predicted, a more appropriate measure of volatility is one which measures the dispersion of "unpredicted fluctuations"[2], that is, changes in the extent to which observed movements in the exchange rate deviate from movements in the equilibrium or expected exchange rate.

In principle, the best approach to identifying any unpredicted fluctuation in the exchange rate is to compare actual changes in the market rate with movements in an equilibrium rate determined on the basis of economic fundamentals. However, this approach suffers from several major problems associated with the estimation of a fundamental equilibrium path for the exchange rate; not the least is that there is little academic agreement on what the fundamentals are and on their exact relationship with the exchange rate. Furthermore, estimates of fundamental equilibrium exchange rates have proven to be highly model-specific.[3]

In response to these problems, some studies have employed simple time-series models to identify a long run average or an expected time path in a currency's exchange value. For example, in a previous attempt to measure the dispersion of unpredicted fluctuations in the Australian dollar, Mathews and Valentine (1986) employed five different time-series models to estimate an

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2 See Trevor and Donald (1986).

3 For a discussion of fundamental equilibrium exchange rates see Williamson (1985), and Barrell and Wren-Lewis (1989). For an example of the empirical problems involved see West (1987).

average time path for the local currency between 1984 and 1986. In general, they found that the volatility of the Australian dollar was not very different from that of a number of other currencies.

However, this is a questionable approach to estimating predicted movements in the exchange rate. There is now substantial empirical evidence that time-series of nominal exchange rates exhibit non-stationarity, a condition in which the mean and variance of the series are not constant, but time-dependent.[4] In most cases the time-series models used to estimate average time paths for the exchange rate - including many of those employed by Mathews and Valentine - implicitly require that the underlying series be stationary for the estimates to be statistically reliable. Consequently, measures of the dispersion of unpredicted fluctuations in the exchange rate based on these models may be misleading.

In view of the statistical problems involved in estimating a long-run average path for nominal exchange rates, this paper does not explicitly attempt to measure the dispersion of unpredicted fluctuations in the Australian dollar. Instead, the two commonly-used measures of volatility - the average of absolute exchange rate movements and the standard deviation of percentage changes - are employed.[5]

While both measures provide an indication of exchange rate volatility, they are inappropriate for making isolated comparisons of volatility. Any assertion that a currency is "excessively" volatile

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4 See, for example, Meese (1990), Meese and Singleton (1982), and Wasserfallen and Kyburz (1985). Recent empirical tests by Smith and Gruen (1989) accept the hypothesis that the Australian dollar exchange rate since the float exhibits non-stationarity.

5 An alternative measure of exchange rate volatility used by Edey and Elliott (1989) involves identifying so-called "implied volatility" from the market price of currency options contracts. While this approach has some appeal, the lack of a long series of suitable price information on currency options in Australia makes it of limited use in this study.

obviously implies reference to some benchmark of volatility. Two are used here. First, Australian dollar volatility is compared with that of other currencies. Secondly, it is compared with the volatility of other asset prices. This reference to other asset prices acknowledges that exchange rates are like any other auction price, incorporating expectations of future events and moving rapidly in response to new information.

3. Volatility of the Australian dollar

Table 1 shows the volatility of daily changes in the Australian dollar for each of the past ten years and for two sub-periods; pre-float - beginning 1980 to 9 December 1983 (1980-1983) - and post-float - 12 December 1983 to end 1989 (1984-1989). Using the measures outlined, volatility is calculated for the AUD/USD exchange rate and for two measures of the dollar's effective exchange rate. The first is the traditional bilateral trade-weighted index as published by the Reserve Bank, while the other is derived from the IMF's multilateral exchange rate model (MERM).[6]

The Table shows that floating the Australian dollar has been accompanied by an increase in exchange rate volatility. The generally higher volatility in 1983 compared with earlier years reflects the impact of the 10 per cent devaluation of the currency early in that year and speculative pressures in the foreign exchange market towards the end of the "crawling peg" regime.

Focusing on the six years since the float, the pattern of Australian dollar volatility is the same for each measure. The volatility of the dollar was generally higher in 1989 than it was during the first year of the float, but not as high as in either 1985 or 1986, and in line with the average for the post-float period. The volatility evident around the middle of the decade reflects uncertainties

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[6] For a description of the IMF's MERM, see Artus and Rhomberg (1973) and Artus and McGuirk (1981).

associated with strong downward movements in the value of the Australian dollar during that period.

Table 1

Australian Dollar Volatility

	Standard Deviation of Daily Percentage Change	Average Absolute Daily Percentage Change
AUD/USD		
1980	0.22	0.16
1981	0.29	0.22
1982	0.24	0.19
1983	0.69	0.22
1980-1983	0.40	0.20
1984	0.48	0.36
1985	1.03	0.74
1986	0.76	0.52
1987	0.57	0.41
1988	0.64	0.49
1989	0.72	0.51
1984-1989	0.73	0.51
TWI		
1980	0.06	0.03
1981	0.09	0.06
1982	0.10	0.05
1983	0.68	0.14
1980-1983	0.34	0.07
1984	0.41	0.30
1985	0.88	0.61
1986	0.75	0.49
1987	0.59	0.40
1988	0.51	0.38
1989	0.65	0.45
1984-1989	0.65	0.44

Table 1 (continued)

	Standard Deviation of Daily Percentage Change	Average Absolute Daily Percentage Change
IMF AUD MERM		
1980	-	-
1981	-	-
1982	0.26	0.20
1983	0.68	0.23
1980-1983	0.51	0.21
1984	0.45	0.34
1985	0.95	0.64
1986	0.78	0.53
1987	0.62	0.43
1988	0.54	0.40
1989	0.68	0.49
1984-1989	0.69	0.47

The volatilities shown in the Table are calculated using movements in the Australian dollar over a 24 hour period and, thereby, incorporate exchange rate movements in both the onshore and offshore markets. Since the offshore market is fragmented between various centres and generally lacks the depth of the local market, the scope for sizeable transactions to disturb the currency in the offshore market should be correspondingly greater. In an attempt to identify the volatility in the two markets, Table 2 shows the volatility of the Australian dollar in the Sydney market between 9.00 a.m. and 4.00 p.m - defined as the onshore market - and the volatility of the dollar outside of these hours, that is, in the offshore market.[7]

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[7] This differentiation between the onshore and offshore market is dictated by data and is not precise; active trading often takes place in the Australian market before 9.00 a.m. and after 4.00 p.m.

Table 2

Onshore and Offshore Volatility

	1984	1985	1986	1987	1988	1989	1984-1989
Standard Deviation of Daily Percentage Change							
AUD/USD:							
onshore	0.35	0.60	0.48	0.36	0.37	0.47	0.45
offshore	0.46	0.97	0.62	0.49	0.58	0.63	0.65
AUD/TWI:							
onshore	0.37	0.59	0.50	0.37	0.34	0.44	0.45
offshore	0.36	0.81	0.59	0.49	0.41	0.53	0.55
Average Absolute Daily Percentage Change							
AUD/USD:							
onshore	0.25	0.42	0.32	0.25	0.25	0.31	0.30
offshore	0.33	0.71	0.43	0.36	0.46	0.45	0.46
AUD/TWI:							
onshore	0.25	0.40	0.34	0.26	0.23	0.30	0.30
offshore	0.24	0.57	0.41	0.35	0.33	0.37	0.38

The results show that, while the pattern of volatility in both markets is the same over the years (as detailed in Table 1), the volatility of the Australian dollar is lower in the local market than in the offshore market in almost all years.

4. Volatility of the Australian dollar relative to other currencies

Table 3 shows the volatility of the AUD/USD exchange rate together with the volatilities of the Swiss franc, Deutschemark, Japanese yen and sterling against the US dollar.

Table 3

Volatility of the Australian Dollar and Other Selected Currencies Against the US Dollar

	AUD	CHF	DEM	JPY	STG
Standard Deviation of Daily Percentage Change					
1980	0.22	0.76	0.60	0.81	0.56
1981	0.29	1.04	0.96	0.72	0.90
1982	0.24	0.81	0.66	0.76	0.61
1983	0.69	0.61	0.56	0.57	0.60
1980-1983	0.40	0.82	0.72	0.72	0.68
1984	0.48	0.67	0.75	0.45	0.63
1985	1.03	1.04	1.00	0.63	1.20
1986	0.76	0.86	0.82	0.76	0.72
1987	0.57	0.78	0.71	0.71	0.64
1988	0.64	0.69	0.65	0.64	0.69
1989	0.72	0.81	0.74	0.72	0.72
1984-1989	0.73	0.82	0.79	0.66	0.79
Average Absolute Daily Percentage Change					
1980	0.16	0.55	0.42	0.59	0.43
1981	0.22	0.82	0.74	0.56	0.68
1982	0.19	0.64	0.51	0.59	0.48
1983	0.22	0.47	0.44	0.43	0.45
1980-1983	0.20	0.62	0.53	0.55	0.51
1984	0.36	0.53	0.59	0.32	0.50
1985	0.74	0.77	0.76	0.43	0.88
1986	0.52	0.68	0.64	0.54	0.55
1987	0.41	0.59	0.53	0.53	0.50
1988	0.49	0.50	0.49	0.45	0.51
1989	0.51	0.62	0.56	0.52	0.52
1984-1989	0.51	0.61	0.59	0.46	0.57

The Table shows that between 1980 and 1983, the Australian dollar was less volatile than the major currencies, reflecting Australia's relatively inflexible exchange rate regime. Volatility

of the Australian dollar has increased since 1983, but it has generally remained lower than for the major currencies. Only the JPY/USD exchange rate has been less volatile, though in 1988 and 1989 the volatility of the Australian dollar and Japanese yen were similar.

Like the Australian dollar, most of the major currencies were more volatile against the US dollar in 1989 than they were in 1984. In addition, with the exception of the yen, all were generally more volatile against the US dollar in 1985 and 1986 than in other years. This suggests that while domestic factors may be the main explanation behind the volatility of the Australian dollar around the middle of the decade, the backdrop was a greater degree of turbulence in world foreign exchange markets.

An alternative to measuring bilateral exchange rate volatility is to compare movements in effective exchange rates. Such a comparison is made in Tables 4 and 5 below. Table 4 shows the volatility of weekly movements in trade-weighted indices of the Australian dollar and several other currencies. For each currency, the component currencies of the index are weighted according to bilateral trade flows.[8] Table 5 compares volatilities calculated from daily movements in the IMF's MERM effective exchange rate series where the weights attached to the component currencies are calculated on the basis of multilateral trade flows.

Tables 4 and 5 show that since 1983 the Australian dollar, on a trade-weighted basis, has been more volatile than the other major currencies. However, care needs to be exercised in interpreting these results. The variability of a currency's trade-weighted index comprises both the variances and covariances of its component

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[8] Volatility of these series is calculated from weekly rather than daily movements. Consequently, the results in Table 4 are not comparable with those in the previous three tables. Australia's effective exchange rate is represented by the Reserve Bank of Australia's bilateral trade-weighted index. Trade-weighted exchange rates for the other currencies were obtained from various issues of JP Morgan's *World Financial Markets*.

currencies. In general, the Australian dollar exhibits less covariation with the currencies of Australia's major trading partners compared with the covariance between, say, the US dollar and the currencies of the United States' major trading partners. As a consequence, the volatility of the Australian dollar trade-weighted index will be higher than the trade-weighted indices of other major currencies. It is not obvious why the covariation of the Australian dollar with the currencies of our major trading partners is relatively low. However, it is likely to reflect the importance of commodity prices in determining movements in the Australian dollar compared with most other major currencies.[9] Furthermore, in the case of the IMF's MERM effective exchange rates, some of the divergence between volatilities may be due to problems in estimating import and export demand equations across broad categories of traded goods.

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9 See Blundell-Wignall and Gregory (1990), and Horton (1989).

Table 4

Volatility of the Australian Dollar and Other Selected Effective Exchange Rates (TWI)

	AUD	USD	CHF	DEM	JPY	STG
Standard Deviation of Weekly Percentage Change						
1980	0.12	0.76	0.67	0.42	1.16	0.80
1981	0.30	0.99	0.86	0.60	1.09	1.11
1982	0.29	0.85	0.71	0.37	1.27	0.74
1983	1.07	0.63	0.57	0.39	0.69	1.06
1980-1983	0.57	0.82	0.72	0.46	1.08	0.95
1984	0.82	0.73	0.42	0.32	0.68	0.62
1985	1.71	1.30	0.67	0.33	1.11	1.24
1986	1.42	0.89	0.63	0.36	1.16	0.97
1987	1.16	0.74	0.40	0.26	1.00	0.64
1988	0.91	0.77	0.35	0.21	0.87	0.72
1989	1.24	0.96	0.59	0.29	0.97	0.71
1984-1989	1.26	0.93	0.53	0.30	0.99	0.86
Average Absolute Weekly Percentage Change						
1980	0.12	0.59	0.51	0.31	0.95	0.66
1981	0.24	0.84	0.67	0.40	0.85	0.84
1982	0.22	0.72	0.55	0.29	1.01	0.49
1983	0.47	0.53	0.42	0.31	0.51	0.77
1980-1983	0.26	0.67	0.54	0.33	0.84	0.69
1984	0.67	0.62	0.33	0.26	0.40	0.48
1985	1.25	0.90	0.53	0.25	0.59	0.93
1986	1.07	0.72	0.49	0.33	0.92	0.75
1987	0.83	0.60	0.30	0.19	0.78	0.49
1988	0.74	0.57	0.30	0.17	0.57	0.52
1989	0.84	0.75	0.39	0.24	0.74	0.54
1984-1989	0.90	0.69	0.39	0.24	0.67	0.62

Table 5

Volatility of the Australian Dollar and Other Selected Effective Exchange Rates (MERM)

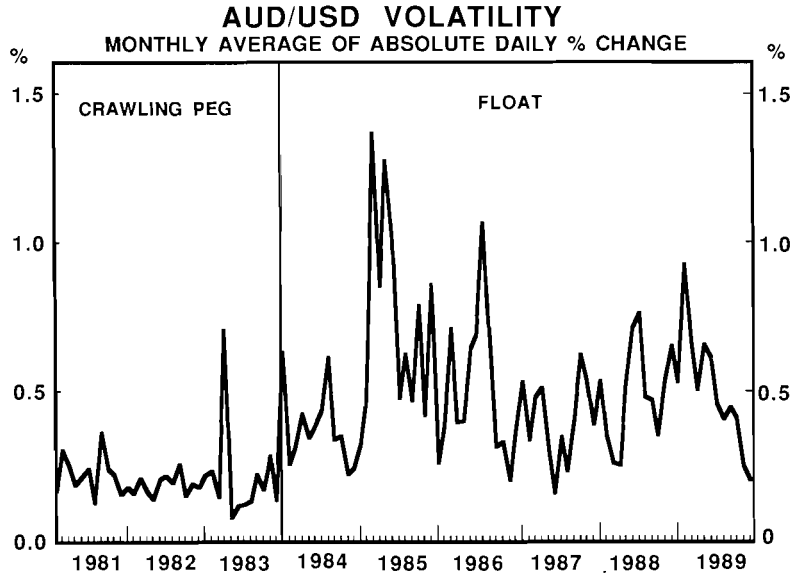
	AUD	USD	CHF	DEM	JPY	STG
Standard Deviation of Weekly Percentage Change						
1982	0.26	0.48	0.47	0.29	0.62	0.52
1983	0.68	0.38	0.66	0.25	0.43	0.56
1980-1983	0.51	0.43	0.57	0.27	0.53	0.54
1984	0.45	0.45	0.31	0.33	0.39	0.37
1985	0.95	0.62	0.57	0.41	0.57	0.69
1986	0.78	0.47	0.49	0.38	0.68	0.62
1987	0.62	0.47	0.41	0.29	0.58	0.39
1988	0.54	0.45	0.34	0.25	0.50	0.39
1989	0.68	0.51	0.43	0.63	0.58	0.44
1984-1989	0.69	0.50	0.43	0.40	0.56	0.50
Average Absolute Weekly Percentage Change						
1982	0.20	0.39	0.36	0.23	0.48	0.30
1983	0.23	0.29	0.29	0.19	0.32	0.36
1980-1983	0.21	0.34	0.33	0.21	0.40	0.33
1984	0.34	0.36	0.23	0.25	0.25	0.28
1985	0.64	0.45	0.39	0.28	0.35	0.50
1986	0.53	0.36	0.39	0.27	0.48	0.45
1987	0.43	0.36	0.31	0.22	0.43	0.29
1988	0.40	0.32	0.26	0.18	0.34	0.29
1989	0.49	0.38	0.32	0.28	0.42	0.32
1984-1989	0.47	0.37	0.32	0.25	0.38	0.35

5. Volatility of the Australian dollar relative to other asset prices

It is widely argued that, ceteris paribus, interest rates should be less volatile (and exchange rates more volatile) under a floating exchange rate regime than under a relatively fixed exchange rate regime. Under a fixed system, the impact of foreign exchange

flows is reflected, in the first place, in changes in the central bank's holdings of official reserves. The counterpart is changes in domestic liquidity and short-term interest rates. Under a floating system, the shocks are absorbed through movements in the exchange rate, unless the central bank chooses to intervene in the currency market. A change to a more flexible exchange rate regime should, therefore, result in less volatility in interest rates and greater volatility in exchange rates. Graphs 1 and 2 illustrate this, showing the volatility of the Australian dollar and domestic short-term interest rates in the three years prior to floating the exchange rate and in the six years since.

Graph 1



Graph 2

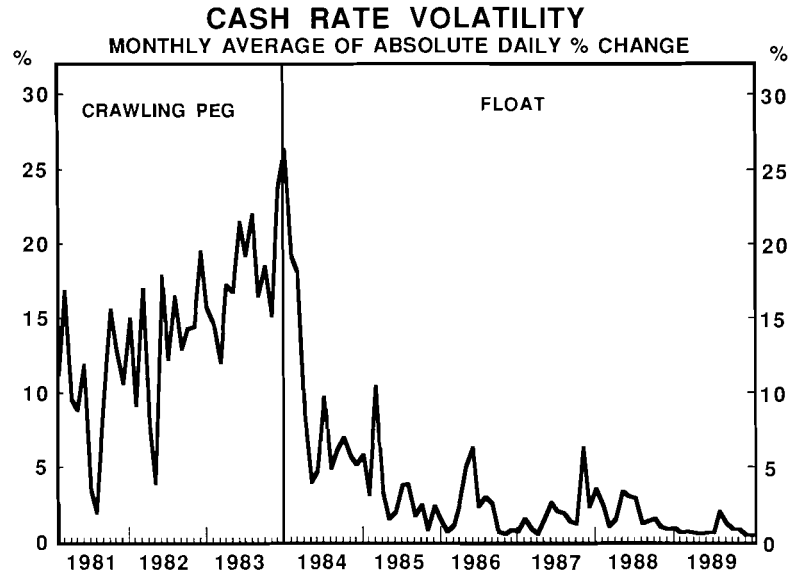


Table 6

Volatility of the Australian Dollar and Other Asset Prices

	AUD/USD	AUD/TWI	AUD/ MERM
Standard Deviation of Daily Percentage Change			
1980	0.22	0.06	n.a.
1981	0.29	0.09	n.a.
1982	0.24	0.10	0.26
1983	0.69	0.68	0.68
1980-1983	0.40	0.34	0.51
1984	0.48	0.41	0.45
1985	1.03	0.88	0.95
1986	0.76	0.75	0.78
1987	0.57	0.59	0.62
1988	0.64	0.51	0.54
1989	0.72	0.65	0.68
1984-1989	0.73	0.65	0.69
Average Absolute Daily Percentage Change			
1980	0.16	0.03	n.a.
1981	0.22	0.06	n.a.
1982	0.19	0.05	0.20
1983	0.22	0.14	0.23
1980-1983	0.20	0.07	0.21
1984	0.36	0.30	0.34
1985	0.74	0.61	0.64
1986	0.52	0.49	0.53
1987	0.41	0.40	0.43
1988	0.49	0.38	0.40
1989	0.51	0.45	0.49
1984-1989	0.51	0.44	0.47

Table 6 (continued)

All Ords	90-day Bank Bills	10 Year Govt Bonds	Gold
1.13	0.81	n.a.	3.20
0.93	0.66	n.a.	1.58
0.91	1.45	n.a.	2.08
0.99	2.24	n.a.	1.65
1.00	1.50	n.a.	2.23
0.80	1.31	0.53	1.23
0.65	1.24	0.63	1.08
0.84	1.36	0.88	1.24
2.22	1.94	0.79	1.01
0.95	0.80	0.60	0.78
0.93	0.49	0.62	0.77
1.18	1.29	0.69	1.04
0.83	0.73	n.a.	2.25
0.70	0.65	n.a.	1.23
0.73	1.16	n.a.	1.53
0.78	1.91	n.a.	1.05
0.76	1.10	n.a.	1.53
0.59	0.96	0.37	0.77
0.52	0.87	0.45	0.74
0.65	0.88	0.66	0.85
1.09	1.10	0.53	0.74
0.74	0.55	0.43	0.60
0.60	0.33	0.43	0.57
0.70	0.79	0.48	0.71

Table 6 shows the volatility of the interest rate on 90-day bank bills and various measures of the Australian dollar exchange rate. Clearly, the increase in exchange rate volatility between the early 1980s and the post-float period has been accompanied by a reduction in interest rate volatility.

Following the approach taken by Frenkel and Mussa (1980), Table 6 also shows the volatility of the Australian dollar together with the volatilities of three other asset price indicators, namely, the All Ordinaries Share Price Index, the yield on 10-year government bonds, and the price of gold measured in SDRs. Focusing on the post-float period, the Table shows that, of the five asset prices, the Australian dollar was the least volatile in 1984, 1986 and 1987, while in 1989 its volatility was exceeded only by the volatility of the All Ordinaries Index. In the period 1984-1989, only the yield on long-term government securities has exhibited lower volatility than the Australian dollar, probably reflecting the infrequent adjustment of inflationary expectations and lower interest rate volatility more generally.

6. Conclusion

The results show that while the move to the float has unambiguously increased the volatility of the Australian dollar, its bilateral exchange rate against the US dollar has not been more volatile than those of the major currencies. Furthermore, the Australian dollar, in general, has not been excessively volatile compared with other asset prices. A comparison of effective exchange rates for different countries shows that the Australian dollar has been more volatile. However, this may reflect relatively low covariation between the Australian dollar and the component currencies of the trade-weighted index.

The paper has also shown that the increase in volatility of the Australian dollar exchange rate in the post-float period has been associated with a reduction in interest rate volatility in Australia. Under a floating exchange rate regime, the burden of adjustment resulting from external shocks has shifted from foreign exchange

reserves and short-term domestic interest rates to the exchange rate. While domestic factors may explain some of the volatility around the middle of the decade, the results show that other currencies were also relatively volatile during this time.

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